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Supplemental Material

Community Water Fluoridation and Urinary Fluoride Concentrations in a National Sample of Pregnant Women in Canada

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Table S1. Characteristics of participants who drank tap water from a public water source and were included in the study and participants who were excluded because they reported a non-public drinking water source (well water or other). Data shown only for participants who provided three urine samples. Values are means \pm SD or n (%) unless otherwise indicated.

Variable	Women reporting a public water drinking source	Women reporting a drinking water source other than public water source
N*	1451	114
Age (yrs) of mother at enrollment	32.26 \pm 4.98	32.82 \pm 4.4
Race		
Caucasian	1234 (85.0)	112 (98.2)
Other	217 (15.0)	2 (1.8)
Marital Status		
Married or Common law	1389 (95.7)	111 (97.4)
Widowed	0 (0.0)	0 (0.0)
Divorced	4 (0.3)	1 (0.9)
Separated	3 (0.2)	0 (0.0)
Single	54 (3.7)	2 (1.8)
Other	1 (0.07)	0 (0.0)
Birth Country		
Born in Canada	1160 (79.9)	108 (94.7)
Born outside of Canada	291 (20.1)	6 (5.3)
Maternal Education		
High school or less	116 (8.0)	8 (7.1)
Some college	74 (5.1)	4 (3.5)
College diploma	322 (22.2)	34 (30.1)
University degree	938 (64.7)	67 (59.3)
Missing	1	1
Pre-pregnancy BMI, mean \pm SD	24.76 \pm 5.41	25.24 \pm 5.58

Employed at time of pregnancy	1248 (86.0)	100 (87.7)
Net income household		
>\$70,000	983 (67.7)	83 (72.8)
<\$70,000	410 (28.3)	30 (26.3)
Refuse to answer or don't know	58 (4.0)	1 (0.9)
Smoking during trimester 1		
Current	70 (4.8)	7 (6.1)
Former or never smoked	1381 (95.2)	107 (93.9)
Smoking during trimester 3		
Current	64 (4.4)	5 (4.4)
Former or never smoked	1387 (95.6)	109 (95.6)
Gestational diabetes	16 (1.1)	1 (0.9)
Caffeine consumption (per day)	0.69 (0.87)	0.71 (0.75)
1 or more caffeinated beverage	1202 (83.0)	99 ()
Did not drink caffeinated beverage	246 (17.0)	15 (13.1)
Alcohol consumption (beer, wine, liquor)		
No alcohol	1188 (82.0)	96 (84.2)
<1 alcoholic drink per month	169 (11.7)	12 (10.5)
≥1 alcoholic beverage per month	91 (6.3)	6 (5.3)

Abbreviations: BMI = body mass index; SD = standard deviation; yrs = years

* One participant did not report type of water they drank; this person was omitted from this table because it was not known which category they belonged to. Data not available for some covariates.

Table S2. Water treatment plant (WTP) reports of fluoride treatment by city. Lab analysis data reported for all sites.

City	Notes about data collection
Vancouver	Fluoride levels for each WTP was documented at <0.05 mg/L for every time point measured between 2008 to 2011. The limit of detection (LoD) for fluoride at the WTPs was 0.05 mg/L. We used a correction factor, $LoD/\sqrt{2}$ (L.D. 1990), to calculate the water fluoride level for the Vancouver sites.
Edmonton	The geomean (GM) was calculated for each WTP in quarters. Because the distribution zones are only general estimates that fluctuate over time and because distribution zones often overlap, mean fluoride measurements were calculated using an average of the GMs from the 2 WTPs. Raw data used to calculate the GM were daily fluoride measurements.
Winnipeg	The GM was calculated for each pumping station in quarters. Fluoridated drinking water values for participants that live in zones that receive water from more than one pumping station were calculated by averaging the GMs from the relevant stations. Raw data used to calculate the GM were daily fluoride measurements.
Toronto	The GM was calculated for each WTP in quarters. Because the distribution zones are only general estimates that fluctuate over time and because distribution zones often overlap, fluoride measurements were calculated using an average of the GMs from the four WTPs. Raw data used to calculate the GM were daily fluoride measurements.
Sudbury	The GM was calculated for each WTP in quarters. Water distributed is a combination of water from two WTPs; therefore, fluoride measurements were calculated using an average of the GMs from both WTPs. Raw data used to calculate the GM were daily fluoride measurements
Kingston	The GM was calculated for each WTP in quarters. Fluoridated drinking water values for participants that live in zones that receive water from more than one WTP were calculated by averaging the GMs from the relevant plants. Raw data used to calculate the GM from King St WTP were fluoride measurements taken approximately five times per month in 2009 and less frequently, four times per year in the following years. Raw data used to calculate the GM from Point Pleasant WTP were fluoride measurements taken four times per year.
Montreal ^a	The GM was calculated for each WTP in quarters. Fluoridated drinking water values for participants that live in zones that receive water from more than one WTP were calculated by averaging the GMs from the relevant plants. Data used to calculate the GM from Atwater and Charles J Des Bailleurs WTPs were yearly average fluoride measurements provided by the city. Raw data used to calculate the GM for Dorval and Pointe-Claire WTPs were taken randomly, approximately every five days.
Halifax	The GM was calculated for each WTP in quarters. Fluoridated drinking water values

	for participants that live in zones that receive water from more than one WTP were calculated by averaging the GMs from the relevant plants. Raw data used to calculate the GM were daily fluoride measurements.
Hamilton	The GM was calculated for each WTP in quarters. Raw data used to calculate the GM were fluoride measurements taken twice daily.
Ottawa	The GM was calculated for each WTP in quarters. Water distributed is a combination of water from two WTPs, therefore fluoride measurements were calculated using an average of the GMs from the two WTPs. Raw data used to calculate the GM from Lemieux WTP were daily fluoride measurements. Raw data used to calculate the GM from the East End WTP were fluoride measurements taken approximately twice per month in 2008 and less frequently, approximately once a month in the following years.

^a Two out of four of the WTPs in Montreal reported large gaps of time in which no fluoride measurements were taken. However, these two plants only supply water to three participants in our sample.

Abbreviations: GM = geometric mean; LoD = limit of detection; WTP = water treatment plant

Table S3. Geometric means (GM) (geometric standard deviation; GSD) by city and by year. Bolded N value refers to total number of participants in each city matched with WTP fluoride data. Non-bolded N refers to the number of participants receiving water from the specific WTP site.

Water Treatment Plant	Year	GM (GSD)	Range	N
<i>Fluoridated</i>				
Edmonton				— ^a
E.L. Smith	2010	0.71 (1.03)	0.65-0.75	
E.L. Smith	2011	0.55 (1.82)	0.09-0.78	
Rossdale	2010	0.71 (1.03)	0.62-0.77	
Rossdale	2011	0.70 (1.03)	0.63-0.76	
Hamilton				184
Highlift	2008	0.68 (1.10)	0.37-0.96	
Highlift	2009	0.56 (1.07)	0.46-0.69	
Highlift	2010	0.56 (1.05)	0.46-0.64	
Highlift	2011	0.56 (1.05)	0.38-0.66	
Highlift	2012	0.57 (1.10)	0.36-0.81	
Halifax				138
J.D Kline	2008	0.82 (1.17)	0.26-1.32	93 ^b
J.D Kline	2009	0.77 (1.16)	0.33-1.10	
J.D Kline	2010	0.71 (1.19)	0.27-1.04	
J.D Kline	2011	0.75 (1.18)	0.28-1.00	
Lake Major	2008	0.76 (1.12)	0.33-0.93	46 ^b
Lake Major	2009	0.69 (1.30)	0.05-1.03	
Lake Major	2010	0.62 (1.17)	0.25-0.93	
Lake Major	2011	0.65(1.20)	0.11-1.18	

Montreal				— a
Pointe-Claire	2009	0.67 (1.10)	0.47-0.75	
Pointe-Claire	2010	0.69 (1.08)	0.53-0.79	
Dorval	2009	0.62 (1.25)	0.21-0.82	
Dorval	2010	0.61 (1.10)	0.44-0.77	
Ottawa				71
Lemieux	2008	0.73 (1.04)	0.60-0.85	
Lemieux	2009	0.73 (1.05)	0.61-0.83	
Lemieux	2010	0.68 (1.04)	0.58-0.80	
Lemieux	2011	0.67 (1.04)	0.54-0.76	
East End	2008	0.69 (1.46)	0.07-0.81	
East End	2009	0.74 (1.07)	0.69-0.84	
East End	2010	0.71 (1.03)	0.67-0.74	
East End	2011	0.71 (1.04)	0.65-0.74	
Sudbury				44
Wanapitei	2008	0.61 (1.56)	0.08-1.15	
Wanapitei	2009	0.67 (1.26)	0.26-0.97	
Wanapitei	2010	0.59 (1.20)	0.37-0.91	
Wanapitei	2011	0.56 (1.40)	0.21-0.91	
David Street	2008	0.61 (1.56)	0.08-1.15	
David Street	2009	0.67 (1.26)	0.26-0.97	
David Street	2010	0.59 (1.20)	0.37-0.91	
David Street	2011	0.57 (1.40)	0.21-0.91	
Toronto				283
R.L. Clark	2008	0.41 (1.57)	0.10-0.59	
R.L. Clark	2009	0.40 (1.74)	0.12-0.62	

R.L. Clark	2010	0.51 (1.52)	0.10-0.73	
R.L. Clark	2011	0.50 (1.51)	0.12-0.70	
R.L. Clark	2012	0.56 (1.21)	0.17-0.69	
Island	2008	0.53 (1.31)	0.13-2.0	
Island	2009	0.46 (1.78)	0.11-0.68	
Island	2010	0.57 (1.40)	0.12-0.78	
Island	2011	0.61 (1.10)	0.21-0.70	
Island	2012	0.58 (1.27)	0.15-0.70	
F.J. Horgan	2008	0.48 (1.25)	0.13-1.51	
F.J. Horgan	2009	0.41 (1.64)	0.12-1.93	
F.J. Horgan	2010	0.46 (1.51)	0.13-0.68	
F.J. Horgan	2011	0.36 (1.77)	0.13-0.68	
F.J. Horgan	2012	0.40 (1.64)	0.14-0.63	
R.C. Harris	2008	0.48 (1.29)	0.10-0.60	
R.C. Harris	2009	0.38 (1.94)	0.11-0.63	
R.C. Harris	2010	0.60 (1.13)	0.18-0.73	
R.C. Harris	2011	0.56 (1.32)	0.14-0.68	
R.C. Harris	2012	0.47 (1.75)	0.12-0.70	
Winnipeg				72
Maclean	2009	0.83 (1.05)	0.59-0.92	38 ^b
Maclean	2010	0.84 (1.03)	0.79-0.88	
Maclean	2011	0.72 (1.08)	0.63-0.86	
Maclean	2012	0.70 (1.03)	0.66-0.75	
McPhillips	2009	0.84 (1.05)	0.73-0.94	25 ^b
McPhillips	2010	0.83 (1.03)	0.78-0.88	
McPhillips	2011	0.72 (1.07)	0.59-0.86	
McPhillips	2012	0.70 (1.03)	0.66-0.74	

Hurst	2009	0.83 (1.05)	0.74-0.93	46 ^b
Hurst	2010	0.86 (1.04)	0.78-1.01	
Hurst	2011	0.71 (1.10)	0.57-0.90	
Hurst	2012	0.7 (1.03)	0.64-0.76	
<i>Non-fluoridated</i>				
Vancouver				154
Seymour	2008-11	0.035 ^c	n/a	
Capilano	2008-11	0.035 ^c	n/a	
Coquitlam	2008-11	0.035 ^c	n/a	
Kingston				184
King Street	2009	0.16 (2.04)	0.02-0.43	143 ^b
King Street	2010	0.20 (1.00)	0.20-0.20	
King Street	2011	0.17 (1.41)	0.10-0.20	
King Street	2012	0.20 (1.00)	0.20-0.20	
Point Pleasant	2009	0.20 (1.00)	0.20-0.20	113 ^b
Point Pleasant	2010	0.20 (1.00)	0.20-0.20	
Point Pleasant	2011	0.19 (1.58)	0.10-0.30	
Point Pleasant	2012	0.20 (1.22)	0.20-0.30	
Montreal				208
Atwater & Charles-J Des Bailleurs ^d	2008	0.13	0.11-0.15	
Atwater & Charles-J Des Bailleurs ^d	2009	0.13	0.13-0.13	
Atwater & Charles-J Des Bailleurs ^d	2010	0.13	0.13-0.13	
Atwater & Charles-J Des Baillet ^d	2011	0.11	0.11-0.11	

Total WTP fluoride values				1359
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^a MIREC minimum sample size requirements precluded reporting of small sample sizes for these sites.

^b Refers to number of participants receiving water from the WTP. Participants can receive water from more than one WTP because some water distribution zones overlap.

^c Limit of detection (LoD) is 0.05 mg/L for Vancouver sites. Values reported in the table for measurements below the LoD used an imputed value of $(\text{LoD}/\sqrt{2})$ (Hornung and Reed 1990) to calculate the water fluoride level. No variation reported because only LoD was provided for this site.

^d Annual average reported by this WTP site

Table S4. Fluoride concentrations in the urine of pregnant women from the MIREC cohort living in fluoridated versus non-fluoridated communities.

	Trimester	N	Arith Mean	Arith SD	Geo Mean	Geo SD	Min	5%	25%	50%	75%	95%	Max
NON-FLUORIDATED													
MUF_Unadjusted	1	541	0.24	0.29	0.15	2.65	0.01	0.03	0.08	0.15	0.30	0.69	3.56
	2	509	0.32	0.33	0.23	2.22	0.03	0.06	0.13	0.22	0.38	0.90	3.54
	3	476	0.47	0.39	0.36	2.05	0.04	0.11	0.22	0.36	0.60	1.23	3.77
MUF _{SG}	1	541	0.31	0.39	0.20	2.56	0.01	0.04	0.12	0.20	0.35	0.84	4.67
	2	507	0.39	0.32	0.31	1.89	0.04	0.12	0.21	0.29	0.46	0.96	2.44
	3	475	0.48	0.32	0.40	1.78	0.08	0.17	0.28	0.38	0.56	1.09	2.71
MUF _{CRE_1}	1	533	0.50	0.50	0.35	2.40	0.01	0.08	0.22	0.37	0.60	1.41	4.5
	2	502	0.58	0.44	0.48	1.85	0.06	0.19	0.31	0.46	0.69	1.47	3.31
	3 ^a	386	0.67	0.47	0.56	1.75	0.12	0.24	0.40	0.54	0.79	1.45	4.61
MUF _{CRE_2}	1	534	0.41	0.45	0.29	2.42	0.01	0.06	0.18	0.30	0.49	1.15	4.81
	2	502	0.43	0.32	0.35	1.85	0.04	0.14	0.23	0.34	0.51	1.08	2.43
	3 ^a	386	0.48	0.33	0.40	1.75	0.08	0.17	0.29	0.39	0.56	1.04	3.29
FLUORIDATED													
MUF_Unadjusted	1	762	0.57	0.49	0.40	2.57	0.02	0.06	0.23	0.43	0.79	1.48	3.98
	2	728	0.71	0.53	0.56	2.03	0.04	0.17	0.35	0.56	0.89	1.68	3.77
	3	712	0.82	0.60	0.63	2.04	0.11	0.19	0.39	0.64	1.06	1.99	4.36
MUF _{SG}	1	762	0.52	0.46	0.37	2.44	0.01	0.07	0.25	0.4	0.64	1.30	3.84
	2	728	0.71	0.47	0.59	1.84	0.03	0.23	0.40	0.58	0.87	1.63	3.78
	3	711	0.88	0.55	0.74	1.81	0.08	0.27	0.51	0.77	1.08	1.89	3.97
MUF _{CRE_1}	1	757	0.83	0.68	0.60	2.44	0.01	0.12	0.39	0.65	1.09	2.19	4.89
	2	723	1.13	0.77	0.93	1.91	0.05	0.32	0.61	0.91	1.42	2.63	4.89
	3 ^a	546	1.30	0.82	1.10	1.86	0.12	0.41	0.72	1.08	1.63	3.10	4.63
MUF _{CRE_2}	1	759	0.68	0.58	0.49	2.46	0.01	0.09	0.31	0.53	0.88	1.80	4.61
	2	727	0.85	0.60	0.69	1.92	0.04	0.24	0.45	0.67	1.05	2.00	4.66
	3 ^a	553	0.97	0.68	0.80	1.90	0.09	0.29	0.52	0.78	1.18	2.41	4.78

^a Trimester 3 creatinine was analyzed at a separate lab, which reflects the lower sample size relative to trimesters 1 and 2

Abbreviations: MUF_{SG}: maternal urinary fluoride adjusted for specific gravity; MUF_{CRE_1}: maternal urinary fluoride adjusted for creatinine using the Hauser et al. (2004) method; MUF_{CRE_2}: maternal urinary fluoride adjusted for creatinine using the WHO (2014) method

Note: Means were calculated after removing outliers defined as a MUF concentration ≥ 5 . The calculation of MUF_{CRE_1} was more prone to outliers relative to MUF_{CRE_2} which explains the slight differences in sample size between the two methods.

Table S5. Comparison of maternal urinary fluoride using propensity-score matching (Rosenbaum and Rubin 1983) as a function of residential fluoridation status matching on the covariates (BMI, maternal age, smoking status, of glasses of water, as well as amount of green and regular tea consumption).

Fluoride measure	<u>Fluoridated</u>				<u>Non-fluoridated</u>				<i>F</i>	<i>p</i>
	N	Mean	Median	SD	N	Mean	Median	SD		
MUF_Unadjusted	426	0.68	0.58	0.41	426	0.35	0.28	0.24	340.7	< 0.0001
MUF _{SG}	339	0.73	0.63	0.41	339	0.42	0.34	0.38	279.6	< 0.0001
MUF _{CRE_1}	339	1.22	1.03	0.69	339	0.63	0.51	0.48	277.0	< 0.0001
MUF _{CRE_2}	339	0.91	0.77	0.52	339	0.47	0.39	0.35	273.6	< 0.0001

*Units: MUF_Unadjusted =mg/L; MUF_{SG} = mg/L; MUF_{CRE_1} = mg/g; MUF_{CRE_2} = mg/L

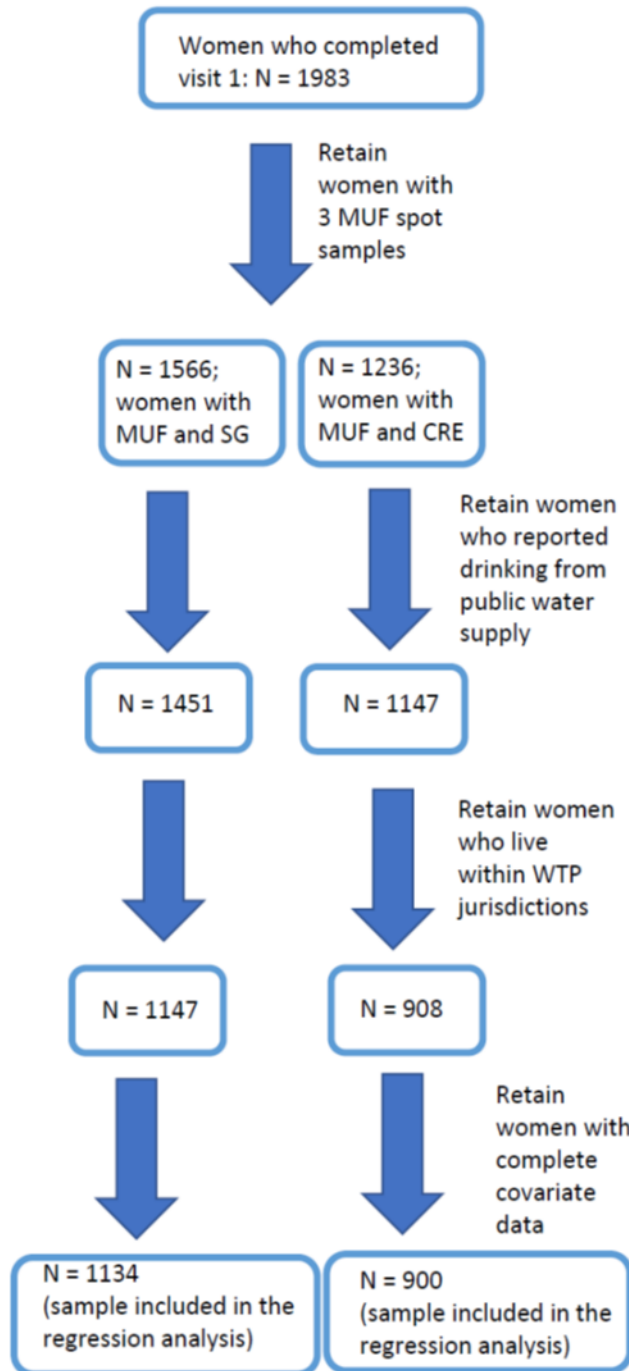


Figure S1. Sample flow chart accounting for participants that were excluded from the regression analyses predicting maternal urinary fluoride adjusted for specific gravity (SG) or creatinine (CRE).

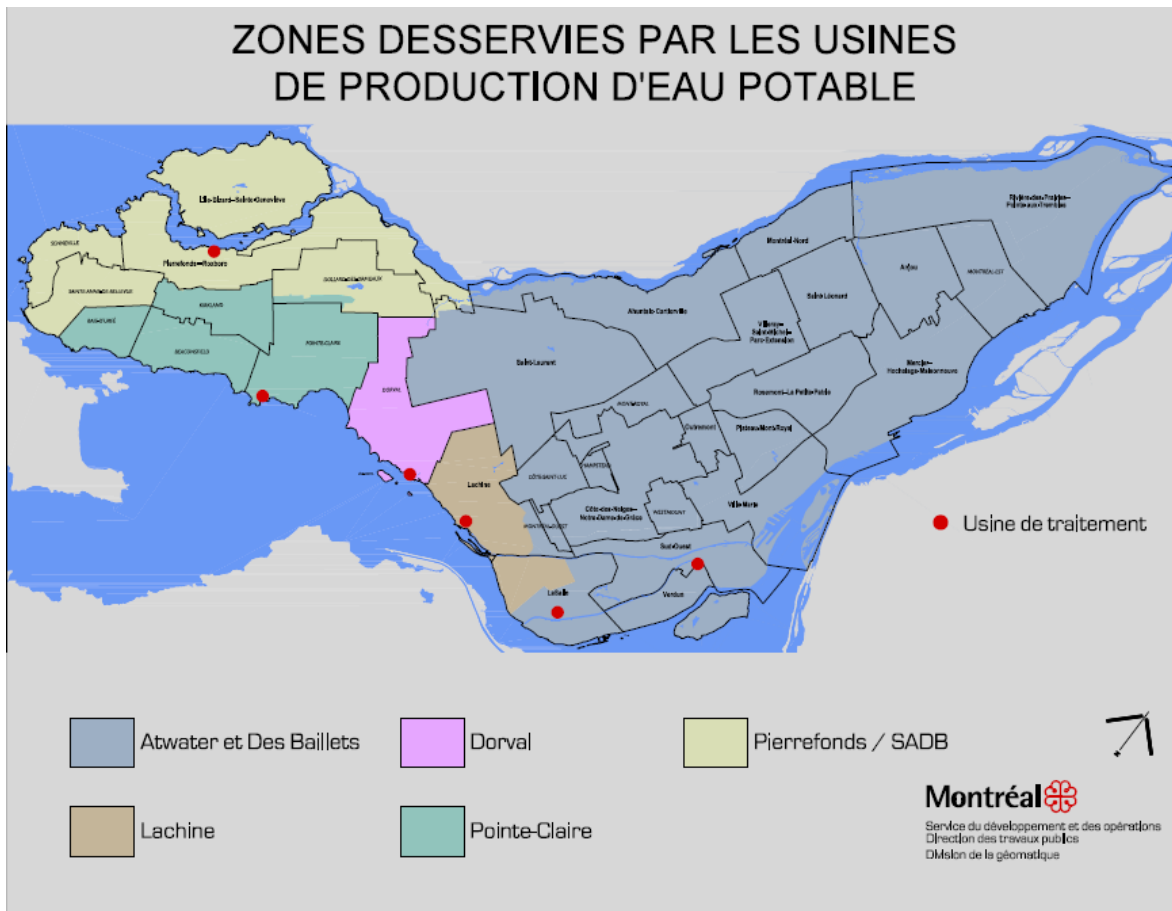


Figure S2. Sample map showing regions serviced by each WTP in Montreal

http://ville.montreal.qc.ca/pls/portal/docs/PAGE/EAU_FR/MEDIA/DOCUMENTS/USI-NE-MOD-18-SEPT.PDF

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